

Casement Window System and Components and Hardware Therefor

Field of the invention

[001] This invention relates to casement windows generally and particularly to casement windows where the window sash is swingably mounted in the window frame and opens outwardly, for example, by means of a crank located
5 conventionally at one side or the other of the window frame.

Background of the invention

[002] Conventionally, the manufacturer of casement windows whether the fixed window or swinging sash type starts with an extruder who extrudes the window frame and sash profiles to meet the requirements of the customer
10 who is the actual window manufacturer who then fabricates the frames from these profiles.

[003] To complete the windows, these fabricators must assemble the window frame and glazing unit and in the case of the swinging sash must purchase
15 the necessary hardware to mount the sash in the window frame for its opening and closing function; the operating hardware for effecting the opening and closing movement of the sash; and the hardware for locking the sash in the closed position.

[004] Customers of the swinging sash window fabricators will, of course,
20 require windows of different sizes so that the fabricator must keep an inventory of hardware to fit the various sizes of windows he is required to supply. Further, the mounting of the hardware requires some machining of the frames assembled from the profiles supplied.

[005] It will be appreciated that if the profiles are not accurately cut and
25 assembled into the frames or subsequently properly machined to receive the hardware they become expensive waste items so that all in all the cost of the material in the form of the extrusions, the hardware for swinging sashes,

potential waste costs, and costs in assembling the frames and the hardware costs make such casement window relatively expensive.

- [006] Moreover, conventional swinging sash casement windows for the residential market provide a window opening movement in which the sash is operated from an operator at one side of the window frame and swings to a position where it extends outwardly from the window frame at some point between the sides of the window frame thus reducing the egress area of escape through the window to just a portion of the size of the window frame opening.
- 10 [007] Again, it will be appreciated that in some cases it is desirable that the window sash open outwardly towards the left and sometimes to open outwardly towards the right depending upon the window arrangement into which the casement window is to be incorporated. To provide for this flexibility of the customers demands, the fabricator must carry the necessary extensive hardware inventory to accommodate the customer's selection.

- [008] It is the object of the present invention to provide a new casement window manufacturing system and frames and matching hardware therefore which will greatly simplify the manufacture and materially reduce the costs of, and the time taken to, produce casement windows and to provide such windows which have important functional advantages over conventional casement windows.

Summary of the invention

- [009] In its broadest aspect the invention resides in eliminating the use of extruded frame profiles and the need to assemble these profiles into the requisite frames by the window fabricators and instead as a supplier to the window fabricators to provide the fabricators with precisely accurate molded frames ready for assembly into casement windows.

[010] With respect to swinging sash casement windows, another aspect of the invention involves producing and supplying, along with the molded frame,

novel hardware to mate with the frames to provide for quick and easy and correct attachment of the hardware to the frame and assembly of the frames to complete the casement window without any machining of the frames.

5 [011] In this connection the frames are molded to accept without machining hardware for swinging the sash in the usual window installation to open outwardly either to the left or right and to provide upon opening essentially the entire window frame opening as an egress escape route.

10 [012] More particularly, in this connection, according to the preferred form of the invention, the window frame provides for the mounting of the sash operator at a central location whether the window opens to the left or to the right.

15 [013] In keeping with the preferred form of the molded window frame, provision is made for mounting of a locking device at either side of the window to enable locking of the window whether opening to the left or to the right when closed.

[014] Again, according to the preferred form of the invention, the mating hardware for the molded frames is formed to be expanded by means of simple extensions to accommodate casement windows of different sizes so that the fabricator of the casement windows need maintain a minimum
20 inventory of hardware parts produced according to the invention both for windows opening to the left and to the right and for different sizes of window such as three foot, four foot or five foot windows.

[015] Still another feature of the invention resides in the manner of assembly of the glass pane or glazing member with its supporting frame whether the
25 supporting frame is a sash for a casement window with a swinging sash or the supporting frame is the window frame for a fixed window casement window.

[016] These and other features of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings showing a casement window with a swingable sash.

Brief description of the drawings

5 [017] Figure 1 is a perspective view taken from the inside of a casement window according to the invention and showing the sash partially opened to the left.

[018] Figure 2 is a perspective view of the casement window of Figure 1 taken from outside the window showing the sash in the partially opened
10 position.

[019] Figure 3 is a broken away perspective view showing the sash separated from the window frame ready to be hinged thereto.

[020] Figure 4 is a broken away perspective view showing the locking mechanism for locking the sash in the closed position.

15 [021] Figure 5 is a vertical sectional view of the casement window with the sash closed and showing the sash operating mechanism.

[022] Figure 6 is a broken away exploded perspective view showing the operating mechanism which mounts on the window frame sill about to be assembled with the sash trackway.

20 [023] Figure 7 is a horizontal sectional view showing the sash locked in the closed position.

[024] Figure 8 is a simplified diagrammatic view illustrating the operation of the sash hinged at the left and swinging open to the left.

[025] Figure 9 is a simplified diagrammatic view, similar to Figure 8, but
25 showing the sash hinged at the right and opening to the right.

[026] Figure 10 is an exploded broken away perspective view of the window sash.

[027] Figure 11 is an exploded perspective view of the sash operating mechanism.

- 5 **[028]** Figure 12 is a perspective view showing the operating arm provided with extensions to accommodate different widths of windows.

[029] Figure 13 is a perspective view showing how the operating arm stamping can be formed to provide a gear at the end to open the sash either to the left or the right.

- 10 **[030]** Figure 14 is an elevational view of the sash locking mechanism and showing the mechanism in the unlocked position.

[031] Figure 14a is a side elevational view of one of the studs used for controlling the locking bar movement and for cooperating with the locking bar hook.

- 15 **[032]** Figure 14b is an end view of the stud of Figure 14a.

[033] Figure 15 is an enlarged elevational view of the connection between the sash locking bar and the locking lever or handle.

[034] Figure 16 is an elevational view illustrating the position of the locking lever with the locking bar in the sash locking position.

- 20 **[035]** Figure 17 is an elevational view of the locking bar with the locking lever or handle being moved to draw the locking bar down out of sash locking position.

[036] Figure 18 is an enlarged perspective view of the locking mechanism control.

[037] Figure 19 is an exploded view showing the locking lever adapted to be mounted on the link which is connected to the locking bar.

[038] Figure 20 is an exploded perspective view illustrating the link ready for attachment to the lower end of the locking bar.

- 5 [039] Figure 21 is an exploded perspective view of one of the members of the hinge which is to carry the spring loaded pin.

- [040] Figure 22 is a vertical sectional view showing the barrel of the hinge member shown in Figure 21 in vertical alignment with the barrel of the lower or under mating hinge member with the spring loaded pin retracted ready to
10 enter the barrel of the lower mating hinge member.

[041] Figure 23 is a view similar to Figure 22 but showing the spring loaded pin carried in the barrel of the upper hinge member projected into the barrel of the under hinge member.

Detailed description of the invention

- 15 [042] With reference first to Figures 1 and 2, the casement window illustrated therein comprises a one piece molded window frame generally designated at 1 preferably formed by injection molding to which is hinged a sash generally designated at 2, the frame 3 of which is again a one piece molded unit preferably produced by injection molding.

- 20 [043] Opening and closing operation of the sash 2 is controlled by an operating mechanism generally designated at 13 hereinafter more fully described mounted centrally of the width of the sill 4 of the window frame and operated by a crank handle 5.

- [044] The window frame 1 is adapted for mounting of the sash 2 to swing
25 open to the left or alternatively to swing open to the right. In Figures 1 and 2, the sash 2 is shown mounted to swing open to the left as viewed from the inside of the window.

[045] To provide this swinging movement, the sash is hinged to the window frame by specially developed hinges comprising hinge members 6, one mounted on the window frame and one mounted on the sash frame, so arranged that their hinge barrels 7 are brought into vertical registration to receive a pin 8 which is projected from the upper member 6 into the hinge barrel of the lower member 6 as hereinafter more fully explained.

[046] The hinge member 6 secured to the window frame is mounted on wall 9 and the hinge member 6 secured to the sash frame 3 is mounted on wall 10 at right angles to the plane of the sash.

10 [047] Since the sash may be mounted to swing open in either direction, it will be understood that the opposite side of the window frame 1 will be identical with the side shown in Figure 3 and similarly the opposite side of the sash frame 3 will be identical with the side shown in Figure 3.

15 [048] The walls 9 on both sides of the window frame 1 also provides for the mounting of an elongated bar 11 of the locking mechanism generally designated at 12 in Figure 4.

[049] It will be understood that the locking bar 11 will be mounted at the side of the window frame opposite to the hinges 6.

20 [050] With reference to Figures 5 and 6, it will be seen that the operating mechanism 13 is received in a recess 14 in the sill 4 of the window frame 1 (Figure 5) and includes a worm gear 15 operated by the crank or handle 5. This worm gear in turn engages a gear 16 mounted on a plate 17 as hereinafter more particularly described.

25 [051] Gear 16 is attached to an operating arm 18 which carries a wheel 19 at its outer end which engages in a trackway 20 secured to the underside of the sill 21 of the sash frame 3. The arrangement is such that operating the crank arm 5 turns the worm gear 15 which in turn meshing with the gear 16 which swings the arm 18 to run the wheel 19 along the track 20 formed to contain

the wheel to effect swinging movement of the sash on its hinge connections to the window frame.

[052] With reference first to Figure 10, the sash frame 3 has a frame border wall 3a and an inwardly projecting stop wall 3b.

5 **[053]** The inside of the wall 3a is provided with a series of slots 3s therein while the wall 3b is provided with a series of spaced ribs 3r for supporting rubber blocks or pads 3p to cushion the panes of glass 22 held apart by the spacer frame 22a constituting the glazing unit 23.

[054] The glazing unit 23 is secured to the sash frame with the usual double
10 sided tape (not shown) while four locking bars 24 are employed to lock the glazing unit in place. The details of these members 24 and their locking further is shown in Figures 5 and 7. It will be understood that except for their lengths the bars are the same having the same cross sectional shape.

[055] Referring to Figure 5 which shows the bars 24 locking the top and
15 bottom of the glazing unit 23 in the sash frame 3, as seen, the cross sectional shape of each bar 24 is in the form of a channel having one leg in the 24a defining a tongue which projects into a peripheral groove 3g formed in the frame 3. The other leg 24b of the bar 24 carries a resilient or compressible member 24c which engages the glass at one side of the glazing unit 23 while
20 the other side of the glazing unit 23 is supported by a corresponding resilient or compressible member 24c' carried by the sash frame 3.

[056] The leg 24a has formed on the outer side thereof with a series of integral tapered projections or barbs 24p spaced to match the spacing of the slots 3s in the sash frame. The arrangement is such that when the bar 24 is
25 forced into the frame groove 3g the outer ends of these projections 24p will snap into the sash slots 3s.

[057] Because of the taper of the projections 24p, the bar 24 will be cammed to press the bar leg 24b with its resilient member 24c against the glass 22 to

held the glazing unit 23 securely locked in place in the sash frame 3. To release the glass or glazing unit 23 the barbs 24p would have to be released from the slots 3s.

5 **[058]** It will be understood that this same glazing unit locking arrangement is equally applicable to a fixed window casement window where the frame in which the glazing unit is locked is a window frame instead of a sash frame.

10 **[059]** Turning to the operating mechanism 13, since the sash can be mounted to swing in either direction, it will be understood that, as hereinafter more particularly described, the mounting plate 17 is formed for mounting a gear corresponding to gear 16 shown in Figure 6 for swinging the sash in the opposite direction.

[060] The operating arm 18 driven by gear 16 is made up of a base arm 18(a) and extensions 18(b) which can be added as desired to accommodate windows of different widths.

15 **[061]** In a similar vein, dealing with the locking mechanism 4, it will be seen from Figure 4 that the locking bar 11 is formed with a base bar 11(a) and extension bars 11(b) adapted to be fitted together to accommodate windows of different heights.

20 **[062]** Bar 11 composed of the base bar 11(a) and whatever additional extension is required is formed with elongated slots 25 to receive headed studs 26 shown in Figures 14a and 14b which overlie the outer surface of the bar throughout the length of the slots 25 except at the enlarged upper ends 27 of slots 25 which allow for the insertion of the studs through the bar into operating position.

25 **[063]** Extending laterally outwardly and upwardly of the bar are arms 28 which form with the body of the bar 11 hooked formations 29 which are adapted to engage other studs 26 (Figures 14a and 14b) which are mounted

on the sash frame 3 opposite to the hinge side as shown in Figure 2 and illustrated particularly in Figure 7 as discussed below.

5 **[064]** Figure 7 is a horizontal cross section showing the sash 2 hinged to the left side of the window frame 1 and the locking mechanism mounted on the right side of the window frame. This view also shows that the window frame 1 carries a screen 31.

[065] Figure 7 also shows the interaction between the locking bar 1 and the studs 26 carried by the window frame 1 and also the studs 26 carried by sash frame 3.

10 **[066]** As shown in Figures 14a and 14b, stud 26 has a cylindrical body 26a having a non-round preferably octagonal head 26b on each end and a central bore 26c to receive a screw 30.

15 **[067]** Spaced from the head 26b on one end of the stud is an octagonal shoulder 26d. The cylindrical body 26a between the heads 26b and shoulder 26d defines a cylindrical engagement surfaces one of which is to be received in the locking bar slots 26 while the stud head 26b and the stud shoulder 26d overlie opposite sides of the bar to control its sliding motion of bar 11. The other cylindrical surface between the stud head 26b and shoulder 26d is adapted to cooperate with the locking bar hook 29 is discussed below.

20 **[068]** As shown in Figure 7, each of studs 26 for the locking bar is secured in place by screw 30 with the octagonal head 26a of the stud remote from the shoulder 26d received in a non-circular depression well 1w in the window frame. This well 1w being non-circular, and preferably octagonal, provides walls which prevent rotation of the stud 26, as shown in Figure 7.

25 **[069]** In this way, movement of the locking bar 11 will not effect the loosening of the screw 30.

[070] In the same manner, the sash frame 3 is provided with non-circular preferably octagonal wells 3w (Figure 7) which receive studs 26 again secured in place by screws 30.

[071] As illustrated in Figure 7, again one of the heads 26b of the stud 26 is
5 disposed on one side of locking bar 11 while the shoulder 26d is disposed on the opposite side of the locking bar 11. It will be understood that when the sash is closed, as illustrated in Figure 16, the stud heads 26b and the shoulders 26d will overlie opposite sides of the bar as the studs are received the locking hooks 29. With this arrangement, the studs 26 will prevent the
10 sash when locked from being bowed or deflected under strong winds which otherwise might dislodge the hooks 29 of the bar 11 from the sash studs releasing the sash from its locked condition.

[072] Figures 8 and 9 are diagrammatic figures illustrating that the sash 2 can be hinged at the left and opened outwardly to the left (Figure 8) or hinged
15 to the right of the window frame and opened out to the right (Figure 9). As previously explained when the window fabricator receives the injection molded frames 1 and 3 and the accompanying hardware including the glazing unit locking bars 24, he has the ability to assemble the casement window to swing open either to the left or right to fit the window configuration of his
20 customer without having to carry left and right frames and left and right hardware and, of course, without having to fabricate the frames from lineal extrusions.

[073] Figures 11, 12 and 13 particularly illustrate the operating mechanism.

[074] As shown in Figure 11, the plate 17 is a stamping with a central
25 opening 17a, the material from which is deformed to provide an upwardly and forwardly extending support bushing 32 and a downwardly and rearwardly support bushing 33 to support the worm gear 15 to which the crank arm 5 is secured.

[075] A shroud 34 which interlocks with the bushing 32 is used to secure the worm gear 13 in place.

[076] Either side of the slotted center of the plate 17, the plate is provided with a raised gear mounting platform 35 with the left hand gear mounting
5 platform ready to be used for mounting the gear 16 shown in Figure 11. As illustrated in this figure, the gear 16 is connected to the operator arm 18 by a neck portion 36 so that the arm 18 is offset above the plate 17.

[077] The wheel 19 is adapted to be secured to the end of the arm 18 by a pin 37. The gear 16 is adapted to be secured to its mounting plate 35 by a pin
10 38 and the shroud 34 is adapted to interlock with bushing 32.

[078] Figure 12 shows the base portion 18(a) of the operator arm 18 ready to be secured to the extensions 18(b) by means of rivets 39.

[079] Figure 13 shows how an arm stamping 18s in the form of a figure six can be machined into an operating arm with a gear portion 16 for cooperation
15 with the worm gear 15 for either a left or right opening window sash.

[080] The vertical movement of the locking bar 11 is effected by the control mechanism 12 attached to the lower end of the bar as illustrated in Figure 4. To receive this mechanism, the window frame 1 is provided with a slot 40 adjacent the corner 41 of the bottom of the frame jamb through which the
20 control mechanism 12 projects as illustrated in Figure 4.

[081] The details of the control mechanism 12 are particularly shown in Figures 18 to 20.

[082] First turning to Figure 18, it will be seen that the control mechanism 12 comprises a housing 42 which is mounted to the window frame over the slot
25 40 as shown in Figure 1.

[083] Mounted to rotate on the housing 42 is a crank member 43 having a finger grip 44 at one end and a crank arm 45 connected to the other end by a hub 46 about which the crank member rotates on the housing 42.

[084] The crank arm 45 has a projecting pin 47 which engages in a horizontal slot 48 in a link 49 which extends through the window frame slot 40. The link 49 in turn is provided at its end which projects inside the window frame with a mounting platform 50 carrying projecting pins 51 (Figure 20) which engage in holes 52 at the lower end of the locking bar base section 11(a).

[085] The mounting platform 50 of the link 49 also carries projections 53 to engage the sides of the locking bar base for increased stability between the link 49 and the locking bar.

[086] The slot 48 in the link 49 has a restriction 54 at its entrance to provide a feel and also a snap sound during operation of the control mechanism as it reaches the fully unlocked or locked positions as illustrated in Figures 14 and 16 respectively.

[087] In this connection, Figure 14 shows the crank member 43 swung upwardly which moves the pin 47 downwardly to the entrance of the link slot 48 thus causing the link to move downwardly drawing the locking bar 11 downwardly and drawing the hooks 29 downwardly below the studs 26 attached to the sash freeing the sash for opening movement.

[088] Figure 16 illustrates the fully locked position in which the crank member 43 has been swung downwardly to bring the pin 47 at the end of the crank arm 45 to the entrance of the link slot 48.

[089] In both the fully open and fully closed position of the crank member 43, the pin 47 on the end of the crank arm 45 will have passed through the restriction 54 which will be felt and heard by the operator.

[090] In the fully locked position, the movement of the pin 47 in the slot 48 due to the crank arm 45 will have effected upward movement of the link 49 causing upward movement of the locking bar 11 so that the studs 26 on the sash are fully engaged in the hooks 29 of the locking bar securing the sash in the locked position.

[091] As illustrated in Figure 17, as the crank member 43 is moved upwardly, the locking bar 11 is being retracted from the fully locked position.

[092] As the locking bar 11 may be used with windows of different heights and therefore requiring locking bars of different lengths, the locking bar as previously described is made up of the base bar 11(a) and extensions 11(b).

[093] As shown in Figure 4, the ends of the base bar 11(a) and the extensions 11(b) are provided with offset end segments 55 ending in inturned short necked flanges 56 (Figure 4) while the lower ends of the extensions are provided with vertical slots 57 which flare outwardly at the center, the arrangement being such that the slots 57 will receive the necked flanges 56 of the locking bar portion immediately therebelow with the extension in the horizontal position and, when swung to the vertical position, the necked flange 56 will overlie the upper locking bar member to secure it to the lower locking bar portion.

[094] While Figure 1 shows the locking mechanism control 12 on the right hand of the window frame 1, the frame will have a similar mounting slot 40 at the opposite side where the window is to be assembled to swing open in the opposite direction to that shown in Figure 1.

[095] As previously set out, the invention is directed to facilitate the fabricator of casement windows so that he can provide windows to meet the customers requirements with a minimum of assembly operations that are simple and easy to carry without requiring highly skilled craftsmen.

[096] In this connection, for the swingable sash casement windows special easily assembled hinges have been provided which are detailed in Figures 21 to 23.

[097] As illustrated in Figure 21, each of the hinge elements 6 comprises a mounting leg portion 58 having a spacing arm 59. This spacing arm carries at its outer end a hinge barrel carrying arm 60 extending in the opposite direction to the mounting foot. The end of the arm 60 is rolled into the hinge barrel 7. Hinge barrel 7 in turn is adapted to receive a bushing 61.

[098] It will be understood that the hinge members 6 are of identical shape, one for attachment to the window frame 1, the other for attachment to a sash frame 3, so that their hinge barrels 7 are in vertical alignment.

[099] In the case of the upper hinge member 6, the barrel 7 with its inserted bushing 61 is the one which carries the pin 8. This pin 8 is urged out of the barrel 7 by a spring 62 engaging between a collar 63 on the pin 7 and a cap 64 inserted into the upper end of the barrel 7.

[0100] It will be understood that normally the pin 8 will be urged to project outwardly of the hinge barrel 7 as illustrated in Figure 3. However, to assemble the hinging of the sash to the window frame, all that is necessary is to retract the pins 8 which, in the case of Figure 3, will involved retracting the one pin in the hinge member fixed to the window frame and the other pin in the hinge member fixed to the sash frame and then align the hinge barrels of the window and sash hinge members so that they are in vertical alignment at which time the pins 7 will be automatically projected into the hinge barrel of the under hinge member 6 and the hinge completed as shown in Figure 23.

[0101] It will be understood that the casement window may be installed together with adjoining windows either to the left or right or above or below. To this end, as illustrated in Figures 1 and 2 the edges 65 of the window frame project beyond a surrounding flat frame surfaces 66 on both sides of the frame. Mounted in the surfaces 66 are trim receiving bars 67 extending

parallel to the frame edges 65 but leaving the corners 68 of the frame surface 66 exposed. With this arrangement, connecting trim strips or bars (not shown) may be run horizontally or vertically between the frame edges 65 and bars 67 to encompass adjoining installed windows to provide a finished appearance.

- 5 **[0102]** It will be understood of course that the hinges will be mounted to provide for the swinging of the casement window out in the direction required by the customer and the studs 26 for controlling the sliding movement of the locking bar will be installed at the side opposite to the hinges as will the corresponding studs 26 to be mounted on the sash frame 3 for engagement
10 with the locking bar 11.

[0103] It will further be appreciated that whether the sash is hinged to swing open to the left or to the right when swung to the fully open position it will provide an egress opening essentially equal to the full opening of the window frame 1.

- 15 **[0104]** It will be understood that while the preferred embodiment described has the window opening operator and window locking controls mounted on the sill rail of the main frame, the window frame or operating mechanisms can be reversed to operate at the top of the window frame. Also the window could be turned on its side so that what is described above as the window frame sill
20 would become a window frame jamb so that the sash would open upwardly or downwardly. In all cases, the open sash provides the full egress opening.

[0105] While the preferred embodiments of the invention have been illustrated and described, it will be understood that variations may be made therein without departing from the scope of the appended claims.